Project Watershed: Urban Nonpoint Source Pollution Investigation Conducted by High School Students

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Section A

Organization: Reaching Out to Communities and Kids with Science in San Francisco, Department of Geosciences, San Francisco State University.

Title: Project Watershed: Urban Nonpoint Source Pollution Investigation Conducted by High School Students.

Priority Area: Meaningful Watershed Education Experience for Students.

Partners: San Francisco Unified School District
San Francisco Public Utilities Commission.

Target Audience: Fifteen 9th – 12th Graders. 13% African American, 66% Asian, 13% Latino/Hispanic, 7% Pacific Islander.

Section B

Goal: Increase the Number of Students of Color Entering Undergraduate Programs in the Earth and Environmental Sciences.

Objectives: (1) Improve high school students' abilities to develop, design, implement, and disseminate a year-long research investigation;

(2) Increase knowledge of the connection between urban water runoff and adjacent ecosystems such as the Gulf of Farallones National Marine Sanctuary and San Francisco Bay; and

(3) Link the history of environmental injustice in our students' home neighborhoods with environmental contaminants, and the adjacent ecology.

Evaluation Plan:
A pre- and post-test was used as a formative and summative assessment. The questions asked are below. Student provided written responses.

Pre- Post- Test Questions

- What is a watershed?
- What is an estuary?
- What is the function of wetlands? How do they help the environment?
- Why are there few wetlands along San Francisco Bay?
- What is nonpoint source pollution? Where does most nonpoint source pollution come from?
- What is biomagnification? What contaminant is of particular concern here in the San Francisco area that biomagnifies? How was/is this contaminant introduced into the environment?
- Describe what happens to the water you wash down your kitchen sink or toilet.
- What is treated and what is not?
- What are some common contaminants locally (name at least five)? For two of these five, describe how they negatively effect the environment.
- What are three things you do in your house that negatively effect local water quality? What can you do to change these things?

Program Overview

Students' design, implement and disseminate a study to evaluate stormwater run-off near each students home. Fifteen students participate. The program is conducted from August to May covering more than 220 hours of instruction and field work.

Part 1 (August – September): A two week summer classroom intensive is conducted to provide students with the background content knowledge necessary to conduct a stormwater run-off evaluation. Topics covered included: Estuaries, Tides, Nonpoint Source Pollution, General Chemistry (Stoichiometry, Solutions, Balance Equations, etc), Chemistry of Wetlands (oxidation reduction chemistry), Watersheds, Contaminant Review (pesticides, oil/gas, oil/grease, household chemicals, heavy metals, bacteria), Bioaccumulation/Biomagnification, Data Collection/Analysis (EXCEL Skills), Topographic Maps/Compass/Orienteering, Algebra Review, Developing a Method, and History and Importance of the Environmental Justice Movement.

Students then designed a stormwater catchment device that was installed within two blocks of each students house.

Sample Device Design
An affordable stormwater collection device (a) was designed and constructed by participants. The collection devices were installed in storm drains during the month of October 2006 with assistance from the San Francisco Public Utilities Commission (b and c). A device was installed within two blocks of each of the fifteen participants' homes.

Part 2 (October – April): Sample Collection and Data Analysis. Students collected stormwater from 9 locations two times each month from November through April. The samples where then analyzed for the constituents below. Data was graphed and analyzed.

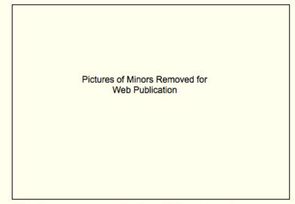
- Oil and Grease: EPA Method 1664
- Toluene: EPA Method 8260B
- Gasoline Range Organics (TPH GRO's): EPA Method 8260B
- Nitrate: NitriVer 3 Method using a Hach Colorimeter DR/850
- Heavy Metals: Samples where filtered to 0.2 µm, acidified with concentrated HCl and analyzed on an ICP-OES.

Part of the installation team (a). Matt prepares the pump prior to extracting the sample (b). Cassandra extracts the samples with a peristaltic pump (c).

Program Overview

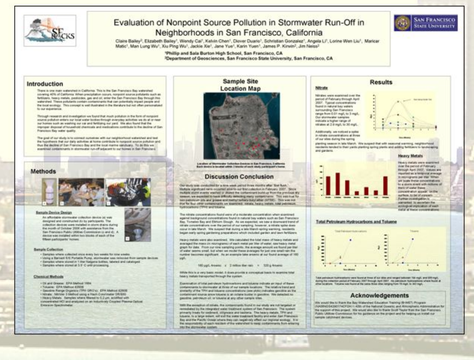
Part 2 (May + December): Students construct a scientific poster summarizing the study and results found. Students published an abstract in *EOS Transactions* and presented the poster at the 2007 Fall Meeting of the American Geophysical Union.

Students also led outdoor workshops for 9th graders. Students taught watersheds, nonpoint sources pollution and tested for nitrates in Islais Creek.



Students present Project Watershed at the American Geophysical Union Fall Meeting 2007.

Section C


Evaluation of Nonpoint Source Pollution in Stormwater Run-Off in Neighborhoods in San Francisco, California

Products/Outputs: Students produced a scientific poster that summarized the results found and work conducted. Copies of this poster are posted in the high school of each student.

Results: Post-test results increased significantly over pre-test results. Responses increased between 75% and 98% over pre-test scores.

Lessons Learned:
Evaluation plan is deficient in scope and does not adequately capture the effort of participants and staff.

Changes Made to Evaluation Plan:
1) Evaluation is now based on the Demonstrative Learning Objectives of each lesson. After each lesson students demonstrate learning objectives by answering questions formed from the learning objectives. All responses are rated on 4 pt. rubric scale. Each student has a unique Identifier so that progress can be evaluated as a group and individually.

2) Same pre/post test as year 1.

3) Two SFSU faculty will rate poster (output) on a 4 pt. rubric scale.

Acknowledgements

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